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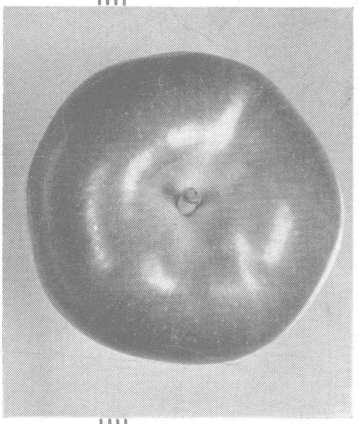
Grading, Packaging and Selling of APPLES under Ohio Conditions



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GRADING, PACKAGING AND SELLING OF APPLES UNDER OHIO CONDITIONS

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INTRODUCTION

Sales of apples for the fresh market in the U. S. make up about 70 percent of total sales. More and more of these apples are being offered to consumers in prepackaged, consumer-size transparent film bags. This operation is done either at the farm or wholesale or retail store levels, depending on the preference of the firm concerned.

It was the purpose of this study to examine the costs of doing the prepackaging job at the farm and retail levels and to determine the most economical place and means of packaging for movement of fresh apples from the farm to the retail customer. Transportation and marketing costs from the farm or country packing shed to the consumers' shopping cart, accounts for well over half the retail price.[2]

While growers have a considerable degree of control over the per bushel growing cost, and a slight degree of control over the grading, packing and transporting cost, they have almost no control over wholesaling and retailing costs. However, it is possible that costs for handling the entire marketing operation can be reduced by changes in the manner and place of packaging into consumer units.

SOURCES AND DATA

Two major types of data were analyzed. The first was from a combination interview and detailed observations of packing operations for the 1955 apple crop. Of the 40 operators interviewed, 31 were observed during their packing operation. An attempt was made to interview all who were prepacking at the country level in Ohio. These 40 operators marketed about 29 percent of the total reported Ohio crop in 1954. Approximately 40 percent of the apples these growers handled were packaged in film bags at the farm. Both the bushel and the consumer packaging operations were studied (Table 1).

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[1]M. E. Cravens, Professor OAES and OSU. R. L. Bere, formerly Instructor OAES.

[2]H. W. Bitting, and H. T. Badger, Marketing Charges for Apples Sold in Pittsburgh, December 1949 to May 1950 (Agricultural Marketing Bulletin No. 47, United States Department of Agriculture, Bureau of Agricultural Economics, Washington, D. C.: June 1951), page 10.

TABLE 1.—Number of Bushels of Apples Sold, By Type of Pack, 40 Selected Operators, Ohio

Type of Pack or outlet	Sold at Farm (Bushel)	Delivered (Bushel)	Total (Bushel)	Percent of Total (Percent)
Polyethylene bags				
4-pound bags	------	173,500	173,500	23.9
3-pound bags	------	71,050	71,050	9.8
5-pound bags	750	33,080	33,830	4 7
Baskets				
Bushel baskets	3,000	85,390	88,390	12 2
Half bushel baskets	5,550	14,500	20,050	2.8
Peck baskets	7,600	2,000	9,600	1.3
Half peck baskets	3,200	5,000	8,200	1.1
Cartons				
Bushel cartons	3,500	87,500	91,000	12.5
Tray pack	------	14,000	14,000	1.9
Paper bags				
Peck bags	19,500	------	19,500	2.7
Bushel bags	15,900	------	15,900	2.2
Half bushel bags	6,500	------	6,500	.9
Other				
Truckers	76,765	------	76,765	10.6
Processors	12,000	17,300	29,300	4.0
Cider*	20,390	20,580	40,970	5.6
Other	10,500	17,000	27,500	3.8
Total	185,155	540,900	726,055	100.0

*Fresh apple equivalent.

The second source of data was from operations in seven chain and three independent retail stores in Columbus, Ohio. Between 8 and 10 observations each of 3-hour duration were made in each store over a period of eight weeks. These observations covered labor and materials used in the prepackaging operations, the labor in moving apples from the backroom to the display, the selling time for clerks and buying time for customers.

USUAL PACKAGING METHODS

Apples were sold at retail from loose (bulk) displays as well as in consumer (prepackaged) packages. The containers in which these

apples were moved from the farmer to the consumer varied, but the principal ones were as follows:

(1) **Bulk fruit in retail stores.** Apples were graded and then packed in a bushel basket or carton at the farm or country shipping point. These containers went through the usual wholesale or chain warehouse channels to the retail store where they were emptied onto the retail display counter. From this display the customer usually served himself by putting the apples into a paper bag then took the bag to the scales where they were weighed, closed, and price marked by a clerk. They were then placed in the shopping cart.

(2) **Prepackaged fruit in retail stores.** The major portion of the apples offered at retail displays were prepackaged in transparent film bags. These bags, usually 3, 4, or 5-pounds each, were prepackaged at one of various levels in the marketing process. The usual routes and methods of packaging were as follows:

a. Grading and prepackaging in consumer packages was done at the farm or country packer level. The consumer packages were then placed in master containers, usually 13–3-pound, 10–4-pound or 8–5-pound, for transporting through the chain warehouse or wholesale channels to retail stores. Most of these either went through chain warehouses or were delivered by the packer directly to chain or independent stores.

b. Graded and packed in bushel basket or carton at the country level and sold directly to chain warehouse or other prepackers where they were packaged into consumer packages at the wholesale level. The bagged apples were then replaced in the bushel container or in other master containers for shipment to retail stores. None of these wholesale level packing operations were studied.

c. Apples were graded and packed in bushel baskets or cartons at the country level and moved through normal wholesale or chain warehouse channels to the retail store. After delivery to the retail store the apples were either prepackaged in the backroom, then transferred to the display or were moved to the retail display and prepackaged by the clerk at this point when time and customers allowed.

COST COMPARISONS

The average packaging and material costs for moving apples from farm to consumers shopping cart by the three usual methods of packaging varied significantly. In addition the costs of master containers, labor and delivery varied considerably from packer to packer for each method.

The consumer packages were more expensive than the bushel containers up to the time of the wholesale delivery to the retail store (Table 2). For instance the 10, 4-pound bag container unit cost 19

TABLE 2.—Comparison of Costs of Marketing a Bushel of Apples from Farm to Wholesale Store or Chain Warehouse, By Type of Pack, Ohio

Marketing Cost Item	Consumer Package			Bushel Package	
	3-pound	4-pound	5-pound	Basket	Carton
	(cents per bushel)				
Labor					
Grading	7.5	7.5	7.5	7.5	7.5
Packing	21.3	18.4	15.4	9.1	6.1
Total	28.8	25.9	22.9	16.6	13.6
Material					
Bags	16.9	14.9	12.4	----	----
Master Container	21.0	21.0	21.0	29.1	32.3
Labels, etc.	3.9	3.0	2.4	----	----
Total	41.8	38.9	35.8	29.1	32.3
Fixed					
Equipment	3.0	3.0	3.0	3.0	3.0
Building	2.4	2.4	2.4	2.4	2.4
Total	5.4	5.4	5.4	5.4	5.4
Storage	21.5	21.5	21.5	21.5	21.5
Delivery	12.5	12.5	12.5	12.5	12.5
Total	110.0	104.2	98.1	85.1	85.3

cents more delivered to the retail store than the bushel basket or bushel carton. The 13, 3-pound bag unit cost about 25 cents more and the 8, 5-pound bag container about 13 cents more than the bushel unit.

COSTS IN RETAIL STORES

No attempt was made to determine the wholesale or chain warehouse cost of handling of the bulk bushel or the equivalent in a prepackaged unit. Since the bulk bushel and the master container for prepackaged apples were of similar weight and size it is likely that the cost of the wholesaling operation for the two packages would be similar.

From the time these apples were unloaded at a retail store until purchased, a detailed record was kept of the direct labor and material costs in retailing. They varied from a low of 4.2 cents per bushel for the apples prepackaged prior to delivery to the store to 42 cents for those put in film bags in the store. Bulk displays required 28.2 cents a bushel in direct labor and material in the retail store. Labor was the major direct cost in the retail store, accounting for all the measured cost of the farm prepackaged apples and 27 out of 42 cents for the store prepacked fruit and 25.2 of 28.2 cents for the bulk fruit.

The calculated labor costs included only the productive labor involved in the retail operation with no allowance for the costs of labor for "coffee breaks", for general housekeeping and for policing the display. "Non-productive" labor items not charged to apples probably accounted for a fourth of the total labor cost in the produce department.[3] If this indirect labor cost were included in the retail prepackaging operation it would further increase the cost advantage of farm prepackaging over that in the retail store. For instance, if a non-productive labor use equal to one-fourth the total is assumed, the direct retail labor cost for farm prepackaged apples would be 5.6 cents instead

[3]Since the farm grading and packing operation was a one product operation and the observed time periods were either a full day or a half day this problem did not occur in the determination of the farm prepackaging labor cost.

TABLE 3.—Labor and Material Costs Involved in Retail Merchandising of a Bushel of Apples, Selected Methods of Merchandising, Columbus, Ohio

Cost	Methods of Merchandising					
	Packaged Prior to Store		Packaged in Store		Bulk	
	Cents per Bushel*	Minutes per Bushel	Cents per Bushel*	Minutes per Bushel	Cents per Bushel*	Minutes per Bushel
Prepackaging	--	--	23.1	11.1	----	----
Setting up display	4.2	2.0	3.9	1.9	12.7	6.1
Serving customers	--	--	----	----	12.5	6.0
Materials	--	--	15.0	----	3.0	----
Total	4.2	2.0	42.0	13.0	28.2	12.1

*Labor calculated at $1.25 per hour

of 4.2 cents, while the labor cost for store prepackaged apples would be 36.0 cents instead of 27.0 cents, and for bulk apples 33.6 instead of 25.2 cents. It is probable that these higher labor cost figures are more realistic than those actually compared in Table 3. Some retailers prefer the fresher pack and claim that there are offsetting advantages of having in-store packaging operations for the use of produce clerk labor. These advantages were not easily subject to measurement but they must be considered.

Operations in the retail store were divided into the cost of labor for prepackaging, setting up the display, waiting on customers and the cost of bags and other materials.

The most striking differences were in the total clerk labor requirement which amounted to 2.0 minutes per bushel for the apples prepackaged before reaching the store compared with 13.0 minutes for those prepackaged in the store and 12.1 minutes for those sold from bulk displays.

The extra cost of 14 cents a bushel for apples prepackaged in the store over bulk sales was due primarily to the 12 cents a bushel higher cost of bags and other material with about 2 cents due to higher labor requirements.[4]

GROWER TO CONSUMER COSTS WITH DIFFERENT METHODS

The lowest total direct cost for the job of marketing apples occurred where the apples were prepackaged at the farm, while the highest cost occurred where the apples were packed in bulk bushel containers at the farm and prepackaged at the retail store (Table 4). The farm prepackaged apples cost 108.4 cents a bushel for the operations studied while for the apples marketed in bushel containers to the store, then prepackaged into consumer packages, the total cost was 127.3 cents. For straight bulk sales the cost was 113.5 cents.[5]

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[4]Additional reasons why stores sell from prepackaged instead of bulk displays is covered in the section on customer and clerk time at time of purchase from bulk and prepackaged sales.

[5]The average net weight of the apples in the 10, 4-pound containers was 42 pounds 2 ounces; for 13, 3-pound units it was 42 pounds 9 ounces and for 8, 5-pound packages 41 pounds 12 ounces. These compared with a bushel basket weight of 43 pounds 6 ounces, while bushel cartons weighed 41 pounds 11 ounces. It is clear that weight differences are not large. However, in the sale from bulk displays all of the weight is counted, while in prepackaged units only 10, 4-pound units are sold from a master of 10, 4-pound units, etc.

TABLE 4.—Comparison of Cost of Moving Apples from Farm to Customers Shopping Cart By Three Common Methods of Packing, Ohio

	Prepacked in		
	Farm Prepacked	Retail Store	Bulk
	(cents per bushel)		
Farm packing and delivery*	104.2	85.3	85.3
Prepacking labor at retail store	----	23.1	----
Labor of setting up retail display	4.2	3.9	12.7
Materials	----	15.0	3.0
Labor of serving customers	**	**	12.5
Total†	108.4	127.3	113.5

*No attempt was made to determine wholesale handling costs. These costs would be similar for the master container of 10, 4-pound bags, etc., and the bushel carton, basket, etc.

**Less than .05 cents.

†No attempt was made to estimate the overhead and other costs in the retail store. The costs here include only the direct labor and materials cost from the backroom to the customers cart. Space, checkout, carry-out and other costs are not estimated.

DISCUSSION OF BULK VS. PREPACKAGED SALE

1. With such a clear cost advantage to the country packed consumer packages why have many stores continued to prepack at the retail level? Some of the reasons follow:

   a. Better quality control

      (1) Grade more dependable. Many retailers have had unsatisfactory experience with the quality of farm prepacked apples.

      (2) Pack fresher at time of sale.

   b. Ignorance of relative costs. The extent of the cost disadvantage for store prepacking is often not known.

   c. Farm or country packed apples are not available in the qualities and quantities desired.

   d. Some store operators feel that prepackaging helps in utilizing clerk labor effectively.

2. With the cost advantage of bulk over store-prepackaged selling why have more and more stores shifted to prepackaged apple selling even though it is done at the retail level? Some of the reasons follow:

a. Better use of store space and clerk labor through prepackaged sale.

Almost two hundred customers were observed and timed as they purchased apples from bulk or prepackaged displays. The average purchaser of bulk apples required 19.2 seconds per pound of apples purchased, while the purchaser of prepackaged apples required 5.3 seconds. The cleark time required at time of sale for prepackaged apple purchases was less than .05 seconds per pound compared with 8.4 seconds per pound for the bulk purchase.

Because of this higher customer and clerk time needed at the time of sale, and the tendency for most supermarket sales to be made in a relatively few hours each week, the bulk sale may be uneconomical even though the total labor used is not excessive. Prepackaging allows many more customers to purchase from a display in a given time period than does the bulk display and it reduces the congestion at the display during this period. At the same time it is possible to economize on the use of clerk time at the peak of customer traffic by having prepacked, preweighed, and pre-priced apples ready for the rush period sales.

b. Prepackaging helps maintain apple quality through the reduction of bruising and loss of moisture of apples on display.

c. Many retailers prefer prepackaging because of its advantage in merchandising. A larger and more varied display can be maintained with packaged apples with less effort.

These advantages could include the appearance of cleanliness of the product, the ease of handling a standardized product at the checkout, and the possibility of greater use of brand and other information on the package.

The fact that the prepackaged display is becoming more common and the bulk display less common attests to the strength of the factors above. The self-service, supermarket type of distribution apparently favors the standardized package as well as the standardized product. The major question is one of where and how this prepackaging is to be done. The previous analysis indicates some of the differences associated with prepackaging at the different levels as well as why stores prepackage at all. Costwise, there was a clear advantage for farm prepackaging over that at the retail store. As more of the problems of quality control and adequate supply are solved, the farm prepackaged proportion of the apples from Ohio that move through supermarkets should be expected to increase at the expense of the store-prepackaged portion.

CUTTING COSTS

The preceding section has dealt with average costs and labor requirements in comparing the efficiency of three major package and packaging methods in the moving of apples from the grower to the consumer.

This section will deal with some of the variations in costs and efficiencies in each method of apple marketing and an analysis of the causes of these variations. Recommendations will be made of the means of reducing these costs wherever the data indicate this possibility.

GRADING COSTS

The cost of grading varied among the 40 growers from 4.5 to 11.2 cents per bushel with an average cost of 7.5 cents. Two factors were observed to affect grading costs. These were: (1) Overall quality or grade of the apples being graded, (2) Scale of operations.

Apple quality—For a similar scale of operation it cost about 50 percent more to grade apples that were 70 percent U. S. No. 1 than for those that graded 90 percent U. S. No. 1.[6] The percentage of the ungraded apples that were of U. S. No. 1 quality or better was used as the indication of quality. This percentage varied among growers from 59 percent U. S. No. 1 or better to 95 percent with an average for all growers of 82 percent.

Size of grading operation—The scale of the grading operation had less effect on grading efficiency than did the quality of the apples being graded. There was a decrease of about one-eighth of a cent per bushel in grading costs for each 10 bushels an hour added volume. While this difference was statistically significant it was so small that in the range of the operations studied it was of little economic importance. The volume of the grading and packing operations varied from 15 to 150 bushels per hour.

Management—An attempt was also made to determine the effect of the quality of management on grading costs. For this purpose management was rated by the enumerator as being below average, average, or above average. Actually, the cost of grading for the group rated as having "above average" management was 2.5 cents a bushel less than for

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[6] $Yc = 21.379921 - .012751X_1 - .158809X_2$
$Yc\,X$ = Cost of grading
X_1 = Bushels graded per hour
X_2 = Percent U. S. No. 1 Grade

TABLE 5.—Effect of Quality of Management on The Cost of Grading Apples, 40 Selected Operators, Ohio

Level of Management	Actual Cost per Bushel	Computed Cost per Bushel*	Difference
		(cents per bushel)	
Better than average	6.1	6.3	+0.2
Average	7.6	7.8	♀0.2
Below average	8.6	7.4	—0.2
Total and Average	7.5	7.6	+0.1

*The computed cost per bushel adjusts the costs for the different grade of apples packed and for the different size or scale of the packing operation.

the group with "below average" management (Table 5). However, 2.1 cents of this 2.5 cents difference could be explained by the better quality of the apples produced and graded and by the larger size of the grading operation. A total of 72 percent apparently was due to the better quality apples graded and 12 percent to the difference in the size of the operation. The remaining 16 percent of the difference (0.4 cents) was due to the unmeasured effects of management and other factors.

PACKING COSTS

The cost of packing varied with the type of pack and package as well as with the efficiency with which each operation was performed. Consumer units and bushel units will be discussed separately.

Consumer units—The labor for packing 5-pound bags cost 3.0 cents a bushel less than for the 4-pound bag and 5.9 cents less than for

TABLE 6.—Labor Cost of Packing a Bushel of Apples, By Type of Package, 40 Selected Operators, Ohio

Type of Package	Number of Operators*	Labor Cost per Bushel	Range in Labor Cost per Bushel
		(cents per bushel)	
Bushel basket	8	9.1	7.5 to 11.1
Bushel carton	10	6.1	4.4 to 8.3
Thirteen 3-pound bags	3	21.3	20.0 to 23.0
Ten 4-pound bags	18	18.4	15.1 to 23.2
Eight 5-pound bags	10	15.4	12.7 to 18.1

*Some operators packed more than one type of package

TABLE 7.—Cost of Prepackaging 4-pound Polyethylene Bags, By Selected Methods, 31 Selected Operators, Ohio

Method of Packaging	Number of Growers	Labor Costs per Bushel			Range in Total Packing Costs
		Packing	Other*	Total	
		(cents per bushel)			
Machine	4	15.1	0.8†	15.9	14.8 to 18.0
Hand					
From Grader	11	17.8	0.0	17.8	15.1 to 20.2
From Table	16	16.4	2.9	19.3	15.1 to 23.3
Total and Average	31	16.8	1.5	18.3	14.8 to 23.3

*Cost of filling open containers to be repacked.

†One of the machine operations was separate from the grading.

the 3-pound unit (Table 6). In order to compare labor costs by different methods of packing, the 4-pound packing operations were used. The least expensive operation, as far as labor use was concerned, was that with some type of filling and weighing machine (Table 7). With semi automatic weighing and bagging equipment the labor cost was 15.9 cents a bushel compared with 17.8 cents where the apples were taken by hand from the grader and 19.3 cents where the hand packing was separate from the grading operation and required an additional handling in filling crates and later dumping them on a table or packing from the crates.

Bushel baskets and cartons—The average labor cost for packing the bushel basket was 9.1 cents compared with 6.1 cents for the bushel carton. Among packers the labor cost for packing the bushel carton varied from 4.4 to 8.3 cents while that for the bushel basket varied from 7.5 to 11.1 cents (Table 6). No attempt was made to explain these variations in costs.

Overweight—Regulations and good sense require that the container must contain the full amount of the stated weight but even a few ounces extra in each consumer package can increase costs considerably. The net weight averaged 42 pounds, 2 ounces for 10, 4-pound bags, 42 pounds, 9 ounces for the 13, 3-pound bags and 41 pounds, 12 ounces for 8, 5-pound bags. This was 2 pounds, 2 ounces; 3 pounds, 9 ounces; and 1 pound, 12 ounces, respectively above the stated net on the packages (Table 8).

TABLE 8.—Average Net Weight of Master Containers and Bushel Units, Ohio

Net Weight	3-pound	4-pound	5-pound	Bushel Carton	Bushel Basket
Under 41 ½ pound	0	2	3	3	0
41 ½ to 42 pound	2	5	3	2	0
42 to 42 ½ pound	1	5	4	1	5
Over 42 ½ pound	0	6	0	4	3
Total Number of Operations	3	18	10	10	8
Average Net Weight	42 lbs. 9 ozs.	42 lbs. 2 ozs.	41 lbs. 12 ozs.	41 lbs. 11 ozs.	42 lbs. 6 ozs.

Note: All prepackaged units converted to 40 pound equivalent stated weight.

The range in overweight in master containers varied among packers from a low of 10 ounces to a high of 49 ounces. No attempt was made to determine the amount of overweight necessary to assure adequate weight. However, packers with the highest amount of overweight also had the greatest variation from container to container. The amount of overweight was not due to the type of scale, the speed of packing, the method of packing or the method of payment for packing (i.e. piecework, hourly, etc.) for these packers.

The variation in weight was much greater for the bulk bushel than for the Master containers of the prepackaged apples. Bushel containers were not sold by weight although the bushel carton had a weight stamped on it.

TABLE 9.—Potential Savings from More Accurate Weighing of Prepackaged Apples

Number of Bushels Packed	Price of Apples per Pound	Pounds per Bushel Above Stated Amount			
		Half Pound	One Pound	One and One Half Pound	Two Pound
5,000	8¢	$200	$ 400	$ 600	$ 800
10,000	8¢	400	800	1200	1600
15,000	8¢	600	1200	1800	2400
20,000	8¢	800	1600	2400	3200

Regardless of the cause of variation, significant savings were possible through more accurate weighing. Table 9 shows the savings that are possible through increases in the accuracy of weighing with various numbers of bushels packed. For many packers in this study, a careful check of the scales and of the accuracy in weighing would have paid good dividends. This applied to bulk as well as to prepackaged apple sales. Of course, in a few instances, especially for the bushel cartons, the weight was below that stated on the carton.

MATERIAL COSTS

The cost of packing materials was even more variable than were labor costs. This variability was due to the type of pack (bulk or consumer), the size of consumer package and the degree to which containers were reused. No attempt was made to evaluate the package cost for roadside or farm sales but it was usually lower than that for other methods of sale.

TABLE 10.—Cost of Plain Polyethylene Bags, By Size of Bag, Ohio

Size of Bag	Number of Growers	Average Cost	Range in Cost	Cost per Bushel
3-pound	6	$13.00	$12.40 to 14.50	16.9¢
4-pound	22	14.90	13.50 to 16.00	14.9
5-pound	13	15.50	14.25 to 17.25	12.4

Note: Bag cost is per thousand.

Bags and inserts—The average cost of the various film bags are shown in Table 10. The range in costs of inserts is shown in Table 11. These ranges in costs are due to the differing care in buying and to volume discounts. The potential savings are great enough to encourage shopping around and buying in volume where possible.

TABLE 11.—Cost of Inserts Used for Prepackaging Apples, 31 Selected Operators, Ohio

Cost per Thousand	Number of Operators	Average Cost
$1.00 to $1.99	11	$1.44
2.00 to 2.99	14	2.45
3.00 to 3.99	6	3.27
Total and Average	31	$2.27

MASTER CONTAINERS AND BUSHEL UNITS

The major variation in material costs was in the cost of the master container for prepackaged apples and in the cost of the bushel container for bulk apples. The two principal methods by which these costs were reduced were the reuse of cardboard containers and the use of field crates for delivery of fruit. There was a wide range in the quality and cost of the cardboard cartons used.

Reuse of containers—The reuse of containers or the use of used containers was common for wholesale bushel lot sales as well as for master containers for consumer packages.

Where the operators attempted to get the return of the cardboard master containers by paying up to 10 cents for each one returned, 42 percent were returned (Table 12). The "new" cost of the containers

TABLE 12.—Cost of Bushel Baskets and Bushel Cartons, By Type of Container, 18 Selected Operators, Ohio

Type of Container	Number of Growers	Average Volume (bu.)	New Cost (¢)	Percent Returned %	Cost of Return (¢)	Net Cost per Trip/Bushel (¢)
			Bulk Shipments			
Bushel basket (Some reused)	3	15,200	36.7	46 6	0.0	19.6
Bushel basket (None reused)	5	18,900	36.7	0.0	0.0	36.7
Bushel carton (Some reused)	3	20,400	36.7	26.6	1.7	27.4
Bushel carton (None reused)	7	21,000	36.9	0.0	0.0	36.9
Total and average						
Bushel baskets	8	17,500	36.7	20.8	--	29.1
Bushel cartons	10	21,200	36.7	12.8	--	32.3
			Prepackaged Apples			
Field crate	12	7,700	60.0	100.0	0.0	5.0
Cardboard cartons (Some reused)	9	24,700	31.0	42.0	5.0	21.0
Cardboard cartons (None reused)	10	24,200	26.0	0.0	0.0	26.0
Total and Average	31	18,200	33.0	32.0	--	21.0

purchased for this system averaged 31 cents with a net cost of 21 cents per bushel per trip being realized where they were reused. Most of those returned were delivered to chain warehouses and the empties were picked up there.

New containers—The operators who depended entirely on new containers paid an average of 26 cents each compared with 21 cents for those who reused as many containers as they could get returned to them (Table 12).

Field crates—Field crates were used by some of the growers, mostly the smaller ones, as containers for direct store delivery of both bulk and prepackaged apples. While the cost of these containers was approximately 60 cents when new, the net cost per trip was estimated at 5 cents a bushel (Table 13). These containers had the added advantage that they were already available and required no additional cash outlay.

TABLE 13.—Cost of Master Containers Used for Prepackaged Apples, By Type of Container, 31 Selected Operators, Ohio

Type of Container	Number of Growers	Average Volume	New Cost	Percent Return	Cost of Return	Net Cost per Trip/Bushel
			¢	¢	¢	¢
Field crate	12	7,700	60.0	100.0	0.0	5.0
Cardboard cartons (Some reused)	9	24,700	31.0	42.0	5.0	21.0
Cardboard cartons (None reused)	10	24,200	26.0	0.0	0.0	26.0
Total and Average	31	18,200	32.8	31.9	--	21.0

Bushel baskets—The average cost of new bushel baskets was 36.7 cents. However, three of the eight operators were able to get an average of 47 percent of them returned for reuse (Table 13). This reuse reduced the container cost per basket to these smaller than average growers to 20 cents a bushel.

Bushel cartons—Bushel cartons cost 36.7 cents each or the same as the bushel baskets. Three of the ten operators using this package were able to reduce their costs to an average of 27.4 cents by reusing the returned cartons. One had to pay five cents for each one returned while two paid nothing for those returned.

EQUIPMENT COSTS

The estimated cost of replacement for grading, packing, and handling equipment varied among the 40 packers from a low of about $50 to a high of about $16,000 (Table 14). The total investment increased from an average of about $1800 for the growers with less than 5,000 bushels (average 3906 bu.) to $9440 for those having over 25,000 bushels (average 53,407 bu.). The investment per bushel declined from 46 cents for the small to 18 cents for the large volume growers.

The estimated annual equipment cost was 5.5 cents a bushel for the packer who packed under 5,000 bushels and only 2.2 cents for those with more than 25,000 bushels.

TABLE 14.—Grading and Packing Machinery Investment and Estimated Annual Operating Costs, By Bushels Harvested, Ohio

Bushels Produced	Number of Growers	Average Production	Value of Equipment*		Annual Cost†	
			Total	Per Bushel	Total	Per Bushel
Under 5,000 bushel	6	3,906	$1804	46¢	$216	5 5¢
5,001 to 10,000	10	7,802	2272	29	273	3 5
10,001 to 15,000	8	12,838	3187	25	382	3 0
15,001 to 20,000	7	16,414	4661	29	559	3.4
20,001 to 25,000	5	23,484	6516	28	782	3 3
Over 25,000	4	53,407	9440	18	1133	2.2
Total and Average	40	16,187	$4050	25¢	$486	3.0¢

*Replacement value.

†Total annual cost = 12 percent of replacement value as follows:

a) Depreciation calculated at 5 percent of cost.

b) Interest calculated at 6 percent of one half replacement cost or 3 percent of replacement cost.

c) Remaining 4 percent covers repairs, taxes, insurance, electricity, etc.

No attempt was made to estimate the effects on equipment costs of factors other than size of operation. Observation indicated, however, that in each volume group some packers apparently were over-equipped and others under-equipped for most efficient operation. Greater care and judgment in figuring the costs and potential savings that can be expected from each piece of equipment was needed to remedy uneconomic investment in equipment.

Thirty-one of the 40 operators had prepackaging equipment for prepackaging apples. Of these, 22 had equipment valued at less than $100 while only four had equipment valued at more than $200 and averaging $450 each, (Table 15).

TABLE 15.—Value of Equipment Used Only for Prepackaging Apples, 31 Selected Operators, Ohio

Range in Value	Number of Operators	Average Value
Under $100	22	$ 43
$100 to $200	5	138
Over $200	4	450
Total and Average	31	$111

TRANSPORTATION COSTS

Growers usually delivered apples from the packing shed to the place of first sale. This delivery was a major cost that frequently appeared to be ignored. Average delivery costs as estimated from these packers were 12.5 cents a bushel of which 7.5 cents was for truck and 5.0 cents was for labor (Table 16).[7] Delivery to retail stores cost an average of 14.7 cents a bushel, compared with 9.2 cents for delivery to chain warehouses. The cost of delivery varied among packers from a low of 9.6 to a high of 38.5 cents a bushel for retail store delivery and 6.1 to 28.5 cents for chain warehouse delivery. These variations were due primarily to the size of load hauled, mileage and operator time required.

Size of load—About 70 percent of the variation in per bushel transportation cost was due to size of load hauled. Generally, operators hauling to chain warehouse or commission firms carried full loads. Loads for delivery to retail stores varied from 10 bushels to 250 bushels each, while those for chain warehouses varied from 125 to 320 bushels and commission firms from 87 to 250 bushels.

Delivery time—The delivery time for retail store delivery averaged 6.6 hours for an average load of 118 bushels compared with 5.7 hours for an average load of 210 bushels to the chain warehouse. The delivery time per bushel was 3.4 minutes for the retail store delivery, 1.6 minutes for the chain warehouse and 2.4 minutes for the commission firm delivery (Table 16).

[7]Truck cost at 12.0 cents per mile and labor at $1.25 an hour.

Mileage—The average mileage on a retail store delivery route was 75 miles compared with 102 miles for the chain warehouse delivery and 184 miles for delivery to a commission house.

Since two of the growers who hired apples hauled for 15 to 30 cents per bushel depending on the distance were not included in the average, it is possible that the estimated average of 12.5 cents a bushel for delivery for all growers does not fully reflect costs for those apples going into commercial wholesale channels.

TABLE 16.—Cost of Delivering Prepackaged and Bushel Units of Apples to Selected Types of Outlets, 40 Selected Operators, Ohio

	To Retail Store	To Retail Warehouse	To Commission House	Average
Number of Operations*	23	17	9	49
Average Load (bu.)	118	210	222	169
High	250	320	250	320
Low	10	125	87	10
Round trip time (hr.)	6.6	5.7	9.0	6.7
High	12.0	11.0	14.8	14.8
Low	0.8	2.0	2.3	0.8
Round trip mileage (mi.)	75.5	101.8	184.3	104.6
High	150.0	240.0	385.0	385.0
Low	6.0	35.0	41.0	6.0
Minutes per bushel (min.)	3.4	1.6	2.4	2.4
High	10.0	4.2	3.9	10.0
Low	1.5	0.7	1.2	0.7
Miles per bushel (mi.)	0.6	0.5	0.8	0.6
High	1.4	1.1	1.7	1.7
Low	0.3	0.2	0.3	9.2
Truck cost per bushel (¢)	7.7	5.8	10.0	7.5
High	19.2	13.2	20.4	20.4
Low	3.6	2.4	2.4	2.4
Labor cost per bushel (¢)	7.0	3.4	5.0	5.0
High	22.0	8.4	8.1	22.9
Low	6.0	2.4	3.6	2.4
Total cost per bushel (¢)	14.7	9.2	15.0	12.5
High	38.5	19.2	28.5	38.5
Low	9.6	4.8	5.1	4.8

*Some operators delivered to more than one type of outlet.

SUMMARY AND CONCLUSIONS

The advent of the self-service store and of transparent film bags has had a profound effect on the marketing and merchandising of apples. The adjustment to these factors is underway at the present time. Consequently, we find a greater than usual diversity of ways of performing similar operations in the marketing of apples.

This study attempts to compare the direct costs for labor and materials in marketing apples without prepackaging with those prepackaged at the country shipping level and at the retail store level.

The average costs of marketing apples from the country storage to the retail consumers shopping cart was 20 cents per bushel less when prepackaged at the country level than when prepackaged at the retail store level. Apples marketed in bulk form and purchased at retail from bulk displays cost five cents more per bushel than those prepackaged at country points. These differences in costs are great enough to indicate the desirability for growers and grower organizations as well as retailers to work out the problems of supplying prepackaged apples direct from country shipping points.

Various means of reducing costs were being used by individual packers. The most important of these had to do with the reduction in the package cost through the reuse of Master containers. The return and reuse of containers was accomplished more easily where delivery was either direct to the retail store or to the chain warehouse than where wholesale channels were used. Savings through the reuse of bushel containers or master containers for consumer packages ran as high as 26 cents per bushel for some packers and averaged 9.5 cents for all who reused them.

Variations in other costs were less than those for wholesale containers. Costs of grading varied significantly with the percentage U. S. No. 1 Grade apples in the apples being graded and with the size of the grading and packing operation. Costs of polytheylene bags and the inserts showing variety, grade, size, and name of packer varied considerably. Costs of delivery varied among packers from a low of 4.8 cents a bushel to a high of 38.5 cents. Significant delivery savings were possible for the packer who recognized the various delivery costs and who planned his routes and increased the size of load hauled in order to reduce them.

Other possible savings included the reduction of overweight in packages and the use of appropriate equipment and arrangement of work in the packing shed. For these there was no set formula for cost reduction. The problem appeared to be the recognition of the fact that a fraction of a cent per consumer package or a few cents a bushel was important. A principal factor was the recognition that every unnecessary motion or handling of the apples or excess weight of apples in the package costs money and in a seasons operation amounts to a significant total.

The savings made by some packers can be duplicated by other packers. The savings on containers were possible through arrangements between individual packers and buyers for the reuse of containers. Such arrangements were easily possible under Ohio conditions because of the nearness of the buyer and packer.

Cost reduction by means other than the reuse of containers are not as obvious nor as easily arranged. However, through planning and organization substantial savings are possible in the packing and container costs for Ohio apple producers and retailers.